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NEW DAIRY FOODS
OPPORTUNITIES and OBSTACLES

Reprinted from FOOD ENGINEERING, August 1970

Printed in USA

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Processors urged to meet the competition of non-dairy imitations. Expert pinpoints many new-product possibilities in eight categories of dairy foods, cites and gages potential advantages and problems.

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BOTH THE AFFLUENT and underprivileged in our society are ready for new, exciting, nutritious products that can readily be made with milk components. The possibilities for combining dairy ingredients with other foods are almost limitless. To fail to do so now only creates a vacuum into which imitations can easily move. However, the new foods must be attractive, convenient, highly palatable and economically competitive with substitutes.

Dairy products which have been developed recently, or which might possibly be developed, are classified in the accompanying tables. Hopefully, they will provoke further thinking and stimulate creativity. The advantages of each group are tabulated along with some possible obstacles to their success. An estimate of the potential of success of each item is also included.

All are made from basic dairy ingredients: milk fat, milk protein, milk sugar and milk minerals. Composition data for each product are available in a reference cited in this article (1).

FRESH FLUID MILK PRODUCTS—TABLE 1
Principal Advantage—Fresh Milk Flavor

Product	Advantages	Obstacles	Potential
Highest quality pasteurized milk	Consumer appeal. Best way to sell milk. No by-products.	Losses in quality. Holding consumer interest.	+++
Low-fat, high-solids milks	Diet and weight control. Can fortify with minerals, vitamins.	Weak fat flavor. Finding best formulation.	+++
Iron fortified 10 mg/qt 0-4% fat	Can determine and add the most assimilable ready source of iron.	Oxidized & rancid flavors. Assimilation of iron from various salts unknown.	+++
High-fat 4% fat	Fine flavor and stability. Sells fat.	High cost. Not for low fat diets.	++
Chocolate 4% fat	Fine flavor and body. Sells fat.	High cost. Not for low fat diets.	+
Fruit flavored strawberry, citrus, etc.	Novel flavor appeal.	Weak fruit flavor. Protein instability. Must be lower than pH 5.5 for flavor.	+
Coffee-milk "Café au lait"	Coffee flavor. Hot or cold.	Lacks flavor appeal in U.S.	+

Fluid Milk Products

Described in Table 1, they emphasize the desirability of producing and selling as much whole milk as possible. Next to whole milk, the largest-volume items are the low-fat, high-solids milks which are often fortified with vitamins and/or minerals. There appears to be a need for an iron fortified milk which, if it is to reach the masses, should not be a premium product. If the fat content of such a product is lowered to compensate for the cost of iron fortification, the product could be sold at the price of whole milk. Fortified at 10 mg

per qt, the actual cost of the iron as dried ferrous sulfate would be about 0.002c.

Cultured products (Table 2) offer an excellent opportunity for new-product development. Buttermilk and yogurt already command a fine market, and variations of these have consumer appeal. New attempts should be made to develop a vigorous cultured dairy product market.

Butter (Table 3) continues to be the best outlet for milk fat, but large quantities of anhydrous milk fat are also produced for food manufacture or for reconstitution with skim milk. The mild, desirable flavor of milk fat may be intensified by heating it as in the process for making ghee. Heating to 266F (2) produces the intense butter flavor obtained by heating butter in a hot frying pan.

Ghee produced this way has much better storage stability than the unheated fat and is suitable for many food manufacturing purposes. Numerous other high-fat products are suggested in Table 3. Swedish dairy and margarine processors have gone to considerable lengths to utilize more butter and margarine. Swedish "Bregott" and margarine are entered in Table 3.

Recent work published in Australia shows that milk containing increased quantities of polyunsaturated milk fat can be produced by observing a certain feeding regimen. Cows were fed encapsulated linseed or safflower oil utilizing capsules composed of equal parts of sodium caseinate and oil. When the casein film was hardened by formaldehyde, the oil was not hydrogenated in the rumen as is usually the case,

CULTURED MILK PRODUCTS—TABLE 2

Principal Advantage—Culture and Acid Flavors

Product	Advantages	Obstacles	Potential
Yogurt gel or fluid body	Consumer appeal. Good keeping quality.	More serum separation in gel than fluid type.	+++
Lactic beverage fermentations. Buttermilk-type body.	Variety of flavors: Citric, carbonic, alcoholic fermentations.	Develop popular flavor. Keep smooth body.	++
Cultured cream	Fine flavor.	High cost.	++
Fruit flavored buttermilk pH less than 4.7. Add 4% sugar.	Strawberry, citrus, raspberry, pineapple. Flavor and body compatible with fruit acid.	Serum separation. Needs good fruit flavor.	+
Kefir milk	CO_2 flavor. Yeast flavor.	Mass production problems. Public appeal unknown.	?
Koumis (cow's milk)	New alcoholic-CO_2 flavor.	Mass production problems. Public appeal unknown.	?

HIGH MILK FAT PRODUCTS—TABLE 3

Principal Advantages—Butterfat Flavor, Utilize Milk Fat

Product	Advantages	Obstacles	Potential
Anhydrous milk fat	High milk fat flavor. Good source of fat.	High cost. Oxidation & staling.	+++
Ghee (heat-treated fat)	Intense cooked butterfat flavor. Useful in manufactured foods. Good storage stability.	Unsuitable for reconstituted milk. High cost.	++
Whippable milk-fat topping	High milk fat flavor. Not a substitute. No coconut fat.	High Cost. Need additives to produce stable, high whip. Oxidation and staling.	+
High milk-fat spread (40% milk fat)	Low cost. Spreadable body. Good flavor.	Lacks full butter flavor. May not be suitable for some uses, butter-frying, etc.	+
Soft milk fat fraction M.P. below 70F	High milk fat flavor. Not a substitute. No coconut fat.	High cost. Oxidation & staling. Crystals below 70F.	+
Hard milk fat fraction M.P. above 70F	High flavor, hard fat for food use.	High cost. Oxidation and staling.	+
Milk-fat-based salad dressing. Soft fat fraction	High milk fat flavor.	High cost. Oxidation and staling.	+
Butter Improved	Non-brittle, spreadable body.	Legal restrictions.	+
"Bregott" Swedish butter-margarine blend; 65% butterfat 20% soy oil 15% poly-unsaturates	Nutritionally "balanced" spread. Stays soft in refrigerator.	Classed as margarine. Same price as butter in Sweden.	?
Swedish margarine. Contains 4-8% milk fat by agreement between Swedish Dairies Assoc. & margarine industry	Increase use of milk fat. Decrease vegetable fat imports into Sweden. Improve flavor of margarine.	Increase costs. Increase competition with butter.	?

but passed through and entered into the milk (3). Aside from legal restrictions, it would seem more satisfactory to add the desired quantity of polyunsaturates directly to the milk.

Unusual Cheese Items

Some of these are shown in Table 4. Per capita consumption of cheese has increased in the United States in recent years, but some new approaches might produce further increases in consumption. A semi-soft skim milk cheese, named Euda, was developed in the Dairy Products Laboratory, USDA (4,5,6,7). This is described in the table. Store tests (8) showed that this cheese is well received by consumers.

Suggestions for a number of dried products are given in Table 5. There is much activity in reverse-osmosis treatment of whey. New whey protein fractions produced by reverse osmosis (RO) will find new and unusual uses in the food industry. Research already done in the Dairy Products Laboratory (9,10) and elsewhere (11) indicates that water can be removed from whey rapidly. And it can be done at a cost at least as low as for vacuum evaporation if the solids content of the finished product does not exceed 15 to 20%.

It apparently will be practical to concentrate whey by RO to 25 or 30% solids, then haul it to a central drying facility. It is too early to know what the exact composition of the RO whey protein fractions will be. But some information will be available soon in the Proceedings of the Whey Utilization Conference (12). It is hoped that this can be confirmed by commercial tests, possibly within a year.

CHEESE PRODUCTS—TABLE 4
Principal Advantage—Expand Cheese Markets

Product	Advantages	Obstacles	Potential
Semi-soft skim-milk cheese (Euda)	Low (6%) fat cheese. Not processed. Naturally ripened. Short ripening period—60 days. Good flavor and body. Increase cheese sales.	Flavor: less than full-fat Cheddar. Body: high moisture. Salt: high (2.4%). Need FDA definition.	+++
Cottage cheese, treated to protect against Salmonella contamination.	Salmonella destroyed by cooking curd at 125F.	Requires high cooking temperature.	+++
Co-ppt. cottage cheese	15% increase in yield.	No coagulable protein in whey.	++
Cheese starter from phosphate-treated milk	Prevents growth of bacteriophage. Uniform cheese. Eliminates dead vats.	Greater care in starter preparation.	+++
Dips, spreads	Body & flavor easy to control. Keeps well at 70F storage.	Need more attractive flavors.	++
Cottage cheese by direct acidification	Uniform cheese. Complete control of curd formation. Can be continuous. Labor-saving.	FDA label problems. Flavor with cream dressing. Automation problems.	+

DRIED PRODUCTS—TABLE 5
Principal Advantage—Reduced Bulk and Weight

Product	Advantages	Obstacles	Potential
Whey protein fractions by reverse osmosis or electrodialysis	Lowered ash and lactose. High protein (25-35%). Useful for foods. High water binding.	Uses and costs must be established and processes perfected.	+++
Flavored, instant skimmilk or whey beverages (choc., coffee, caramel).	High protein beverage for improved nutrition. High flavor potential. (Instant breakfasts)	Precise formulation needed for flavor appeal.	++
CSM: corn—58.0% soy—25.0 wheat—10.0 ndm— 5.0 minerals— 1.9 vitamins— 0.1	Low cost, high nutrition for foreign feeding. Supplies all needed nutrients.	Good acceptance in hungry foreign populations. Domestic appeal unknown.	+++
Whey-soy blend whey—60% soy —40%	Low cost, high nutrition for foreign feeding.	Unusual flavor. Acceptance to be developed.	+
Milk biscuit. Australian (no lactose) New Zealand (lactose)	Milk based, palatable, low-cost food. High protein, vitamins and minerals.	Can it be made and sold in U.S. in volume and at a profit? Storage flavor.	+
Fruit flavored whey powders	Marked fruit flavor enhanced by high lactose.	Flavor changes in storage.	+
Nonfat milk foam spray USDA process	Instant on one pass through dryer. Reconstitutes with foam for beverages.	Low bulk density increases collection and packaging costs.	+++
Whole milks USDA processes Foam spray or vacuum belt	Quick dispersibility. Improved flavor stability. Dry in ozone-free air to improve flavor.	Special gas pack to retard fat oxidation. Cold storage to retard staling. Shelf life, 8 months at 40F.	++
Coffee whiteners with milk fat	Milk fat flavor. Convenient.	Fat oxidation and staling. Cost.	+
Sour cream freeze dried	Convenient. Longer shelf life than fresh.	For heavy, smooth body casein must reabsorb water.	+
Fruit flavored milk powders	Attractive milk-fruit flavor.	Protein instability at low pH. Poor solubility.	?
Dried butter	Convenient. New uses. High nonfat solids.	Staling and oxidation. For food manufacture only.	+

The CSM and whey-soy blend listed in Table 5 were prepared for foreign feeding use. Millions of pounds of CSM have been produced commercially. New and improved dry whole milks could be produced and marketed provided a refrigerated distribution system was used.

Aseptic-Process Foods

Some in the dairy field believe there is a great future for sterile, aseptically packaged dairy foods (Table 6). Puddings are enjoying unusually good sales volume. Butter and sauces are coming forward. Sterile ice cream mixes have been on the market for many years. They have never gained great volume, although a sterile aseptically packaged ice cream mix produced in Britain is being shipped almost worldwide.

Sterile whipping cream has enjoyed limited sales for some years, but it is a difficult product to process and distribute. Volume to which the cream can be whipped probably will never compete with the volume of the aerosol product. The fortunes of the single strength fluid and 3:1 concentrated milks have varied. Being sterile, they are expected to keep well at room temperature. However, a stale storage flavor develops in a few weeks which has lessened their consumer attractiveness. Refrigeration will retard stale flavor development.

Frozen products continue to enjoy considerable success (Table 7). Certainly, frozen novelties head the list. There may be some question as to whether frozen whipped milk-fat topping could compete with frozen vegetable-fat topping, even if a good frozen milk-fat topping were available. The same applies for frozen whipped cream. Frozen yogurt is relatively new and shows considerable promise.

Whey Products

Sherbet would seem to be the logical place for cottage cheese whey. The whey could be used in liquid form instead of water. But whey utilization for this purpose has not attained high volume because of the logistic problem of getting the whey to the place where the sherbet is made. Dried whey can be used, but is more expensive than the fluid form. Frozen 3:1 milk has been under development for almost twenty years and is now being market tested. It is a good product but its success will depend on price and consumer appeal.

The whey products shown in Table 8 should have an excellent future. Uses preferably in food must be found for whey. We are now utilizing about 7 billion lb of whey per year. Since 22 billion lb is produced in the United States each year, we must still learn how to recover, process and utilize another 15 billion lb. We have processing procedures and are developing new ones at a rapid rate. But a large part of the 15 billion lb of unprocessed whey (possibly 7 billion lb) occurs where processing facilities are not readily available.

Probably three-fourths of the whey we process goes into animal feed. The prices received for it barely pay for processing costs. The problem is not so much whether we can, or how we can, process the wasted whey, but what we find to do with it after we get it processed. Some of the products listed in Table 8 may help us find solutions to this problem.

ASEPTICALLY PACKAGED DAIRY PRODUCTS—TABLE 6

Principal Advantage—Bacteriological Stability

Product	Advantages	Obstacles	Potential
Puddings	Convenient. Flavorful.	Flavor & body changes on storage.	+++
Butter or cheese sauce	Convenient. Flavorful.	Need research on formulation and storage changes.	++
Coffee cream	Real cream flavor. Single portion.	High cost. Stales on storage.	++
Egg nog	Convenient. Flavor changes obscured by spices.	High cost. Stales on storage.	++
Chocolate drinks	Convenient.	High cost. Stales on storage.	++
Infant formulas	Complete food. 1-yr shelf life.	Staling not objectionable to infants.	++
Ice cream mix	Convenient supply for small freezing units. Easy to transport.	Shipping cost.	++
Sour cream	Convenient.	Acid must be added aseptically.	+
Whipping cream	Real cream flavor. No fresh returns. Convenient.	High cost. Stales on storage. Fat separation. Low overrun. 40F storage.	+
Single strength fluid milk	Ready source of fluid milk. Long shelf life at 45F.	Stales fast at 70F. Container cost.	+
3:1 concentrate	Saves container & storage space. Makes acceptable fluid milk.	Stales on storage. Lacks ready convenience of fluid milk.	
Shake mix	Chill, shake, serve.	Lacks quality of a shake containing ice crystals.	

FROZEN DAIRY PRODUCTS—TABLE 7

Principal Advantage—Preservation of Flavor and Body

Product	Advantages	Obstacles	Potential
Ice cream novelties	Consumer appeal.	Need new forms to hold consumer interest.	+++
Frozen milk-fat topping	Medium cost. Good flavor. High overrun and stability.	More expensive than vegetable fat toppings.	++
Frozen whipped cream	Fine flavor. Real cream characteristics.	High cost. Needs stabilizer. Storage stability.	+
Frozen yogurt	Flavor and body without deterioration.	Cost of frozen distribution. Fluid type of body only.	+
Sherbet from cottage whey	Smooth body. Whey protein stable with acid fruits. Good milk flavor. Low cost.	Storage flavor develops in 3 months.	++
Frozen 3:1 milk	Space and weight savings. Multipurpose use.	Must hold frozen. Physical changes. Must reconstitute.	?

WHEY PRODUCTS—TABLE 8

Principal Advantages—Increase Food Supply, Eliminate Waste and Pollution

Product	Advantages	Obstacles	Potential
Dried whey:			
(a) commercial spray process: crystallization at 14% H_2O, redry.	All lactose crystallized. Minimum H_2O absorption.	Acid whey dries with difficulty.	+++
(b) foam spray process: gas injection in high pressure spray line.	Instant type powder. Dries acid whey. 70% lactose crystallized. One pass process, no redrying.	Some H_2O absorption. Low bulk density. Needs industry trials.	++
(c) Roller	Low cost.	Animal grade.	?
Dried whey for food	Compatible with acid foods. Good food value. Improves flavor.	Low protein. High ash. Lactose intolerance?	+++
Whey-milk fat mixtures for food uses	Use dry mix for food processing. With 20% H_2O, a spread.	Storage stability. Cost.	+
Dried whey for animal feed	Whey disposal at cost.	Lactose too high for feed. Low profit.	++
Whey products by fermentation: yeast, alcohol, vinegar, feed	Conventional processes. Good products.	Need new, more productive fermentations.	+
Whey protein preparations:			
(a) Heat coagulated, centrifugal separation	Cheap removal, high protein content.	Denatured protein, limited uses.	?
(b) Reverse-osmosis fractionation	Protein not denatured, low cost.	Partial fractionation, membrane development needed.	+++
(c) Electro-dialysis	Protein may or may not be denatured.	High cost, partial fractionation, patented processes.	+
(d) Gel filtration	High protein concentrates.	Laboratory process, high cost.	?
Sweetened condensed whey solids, 37% sugar, 37%	Storage stability. Whips. Good for food manufacturing.	Viscous & sticky to handle. Low whey content.	?
Lactose	Conventional processes.	Need new low cost process and uses.	++

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